

KAY (Thos W.) *able*
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A STUDY OF STERILITY; ITS
CAUSES AND TREATMENT.

BY
THOS. W. KAY, M.D.,
OF SCRANTON, PA.

Being an Essay which received the First Prize of the Alumni Association of the College of Physicians and Surgeons, Baltimore.

Reprinted from the "Journal of the American Medical Association," Feb. 7, 14 and 21, 1891.



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INTRODUCTORY.

General Remarks.—"Be fruitful, and multiply, and replenish the earth," was the first command given to man, and it is as binding to-day as it was at the close of the creation, for a neglect of its fulfilment necessarily implies an extinction of the species. It is the desire, unconscious it may be, to fulfil this command that prompts man to seek the society of woman. The late Dr. Carpenter, of England, says "love" is based on the innate desire for offspring. This fact was recognized as early as the time of Soranus, who says, "As most marriages are not contracted for love, but to beget offspring, it is unwise, in the choice of a wife, to consider her social standing and riches rather than her fitness for bearing children."

Sterility is one of the most potent factors in producing domestic unhappiness, and was so as long ago as the time of Abraham, when, having begotten a child by Hagar, Sarai "was despised in her eyes" because of her unfruitfulness.

Historical.—Though Jacob loved Rachel better than Leah, he turned his affection to his less comely wife after she had borne him a son. After having brought forth several children, Leah exclaims: "Happy am I, for the daughters of men

will call me blessed. God hath endowed me with a good dowry, for I have borne him six sons." The barren Rachel, feeling keenly her disgrace, cries in her anguish, "Give me children or I die," after which we are told that "the Lord saw that she was hated and opened her womb." Among the ancient Greeks, as among the Jews, sterility was considered a disgrace, and was a frequent cause for divorce, the unfortunate woman being looked upon as a lower, or imperfectly developed, being. Travelers, among the inhabitants of nearly all uncivilized countries, remark that the pregnant women take pains to show, and frequently point with pride to, their enlarged abdomens. In Angola, says Livingstone, sterility is such a disgrace and such a cause for ridicule, that the unfortunate women are frequently driven to suicide. Pallas states that the well-to-do Circassians give a dowry to their daughters only after they have proved themselves fruitful.

Among the Moslem inhabitants of Turkey, divorces are very common, and in most cases sterility is found to be the cause. It is from the ranks of these unfortunates that the native prostitutes are obtained.

Sterility and fecundity were frequent themes for the ancient historians and poets. In the *Susruta*, a book of ancient India, conception is said to "take place easiest at the menstrual period, for at this time the mouth of the womb is opened like the blossom of the water-lily in the sunshine." In the Bible we find sterility frequently mentioned, and examples of it are recorded, with remedies for its relief. The Talmud also makes many allusions to it and its remedies. Sterility is frequently mentioned, and discussed at some length, in the works of Hippocrates. Celsus, Pliny and Aristotle also devote some space to it, but enter

into the subject less fully than Hippocrates. Paulus Agineta has much to say on the subject, and devotes some space to the subject of diseases of the female organs of generation. From the works of Maimonides, we know that the subject was frequently mentioned in the writings of the Arabs.

We see, then, the importance that has been attached to it from the earliest times to the Middle Ages, and from that time to the present the question has been gaining in weight.

But what is it?

Definition.—The term “sterility” is applied to both the male and the female, and must not be confounded with impotence, which indicates a physical inability on the part of the male to fulfil the marital rights.

Sterility may be congenital, where the woman, after reaching the age of puberty, has maintained the marital relations for three years without becoming pregnant; or acquired, where, after having borne one or more children, she remains three years, while subject to intercourse, without re-conceiving. By some the term has, in a wider sense, been applied to all who, though becoming pregnant, are unable to bring forth a healthy living child.

Some English writers use the term “only child sterility” to designate sterility acquired after the first birth.

In very few fruitful marriages is the first birth postponed later than the third year. Kisch collected the histories of 556 fruitful marriages and found that, in 156 of these, the first birth occurred in ten months after marriage; in 199, it occurred between the eleventh and fifteenth months; in 115, between the sixteenth and twenty-fourth months; in 60, between the twenty-fourth and thirty-sixth months; and in only 26, or 2.6 per

cent., did it occur after the third year. Duncan gives seventeen months as the average time between marriage and the first birth for the women of Edinburgh and Glasgow. Ansell places it at sixteen months, and finds that less than 5 per cent. bear their first child after the third year. The justice, then, of classing those women as sterile who have not become pregnant during the first three years of married life, is apparent.

It may also be remarked, from the above statistics, that impregnation at the first approach of the male, the rule in brutes, is the exception in man.

Frequency.—The frequency of sterility is much greater than it is generally supposed to be. Of 495 marriages among the English aristocracy, Simpson found 81, or about 16 per cent., sterile. Kisch inquired into the histories of 626 marriages among the royalty and highest classes of Europe, and found sterility in 70, or nearly 12 per cent. The figures for England are large because of the necessity, among the nobility, of marrying near relatives. Ansell, Sims, Simpson and Wells place the general average of sterility, for marriages in all classes, at about 12.5 per cent. Hedin thinks this too high for Sweden, where he claims only one-tenth of the marriages are sterile.

Grünewaldt has collected some very interesting statistics on this subject. After excluding, from 1,500 women suffering from uterine diseases, all virgins, widows, and those over 35 years of age, there remained 900 married women, of whom 500 were sterile. In about 200 of these the sterility was congenital, while it was acquired in the remaining 300. This gives uterine disease as the cause of 60 per cent. of the cases of sterility, and one of every three married women, who suffer from uterine disease, will become sterile.

One must not always look for the causes of sterility in the female, for, as has frequently been the experience with all gynecologists, after having subjected the female to a long course of treatment, the male has been found to be the one at fault. Of 40 unfruitful marriages, Kehrer found the man at fault in 16, or about 35 per cent., and he claims that in a still larger per cent. the male is the indirect cause by transmitting the gonorrhoeal or syphilitic poison to the female, thus setting up changes which militate against conception.

Courty gives the relative frequency of the seat of the causes of sterility in the male and female as 1:10, Duncan gives it as 1:8, and Noeggerath places it as high as 8:14.

Fœtal Development of Genital Organs.—To understand fully the causes and treatment of sterility, it is necessary to have, at least, a rudimentary knowledge of the development of the organs of generation. About the end of the third week, after the ovum becomes impregnated, the allantois begins to develop, and communicates, by the urachus, with the primitive intestine. As the sixth week approaches, the urachus dilates in its lower portion, so as to form the bladder, which communicates with the rectum by a canal—the future urethra. The Wolffian bodies are found, as early as the third week, on either side of the primitive vertebræ. At first they act as primitive kidneys, their ducts emptying into the bladder, but later on they disappear, with the exception of a small portion of each, which can be seen, between the ovaries and Fallopian tubes, as the organs of Rosenmüller. Between the fifth and sixth weeks, two small glandular bodies, formed from the germinal epithelium, begin to make their appearance to the inner side of the Wolffian bodies. These are the genital glands, and they are covered by

the peritoneum which attaches them, as a mesentery, to the Wolffian bodies. With time, the genital glands develop, and at the end of the sixth week they can be recognized as ovaries. They remain, however, in the abdominal cavity till the ninth month, when they descend into the pelvis. Developing contemporaneously with the ovaries, we find the conduits of Müller, situated in front of and to the inner side of the Wolffian ducts. It is from the upper portions of these conduits, extending from their superior closed extremities to that point where the lumbar ligament is attached to the Wolffian bodies, that the Fallopian tubes are formed. In their lower portions the conduits of Müller unite, in a common body, with the Wolffian ducts, to form the genital cord, in which the conduits of Müller are situated, to the rear and separated from each other by a partition.

The absorption of this partition forms the utero-vaginal canal, in which, until about the fifth month, no distinction can be made between the uterus and vagina. It is from those parts of the conduits of Müller, situated between the genital cord and the lumbar ligament, that the cornua of the uterus are formed. At first there is no lower, external, opening to the intestine, but gradually an involution of the epithelium dips down, and, about the fourth week, the septum disappears. At this time the intestine, behind, and the urachus, in front, open into the common cloaca. About the sixth week, a transverse septum is formed across the cloaca, dividing it into the rectum, posteriorly, and the uro-genital opening, anteriorly. The upper portion of the bladder receives the two ureters, while the conduits of Müller and the ducts of Wolff empty into its lower portion. That portion situated between the openings of the four ducts and the point

where the bladder empties into the cloaca is the uro-genital sinus, which forms the vestibule of the vagina. At the junction of the vestibule and the vagina, a fold of mucous membrane—the hymen—is finally formed, which, partially or wholly, closes the opening to the vagina. From these foetal parts all the organs of reproduction of the female are developed, and, bearing them in mind, it will be easy to account for all malformations of the female genitals, a common cause of sterility.

Ovulation.—No organs of the body exert as great an influence over physical development as the ovaries. At birth they are small, smooth and flat, but as age advances they enlarge, and become oval and tense. This is in large part due to the increase in size and approach to the surface of the Graafian follicles, to allow their easy rupture for the discharge of the ova—ovulation.

Menstruation.—Menstruation usually begins about the same time and accompanies ovulation throughout the child-bearing period. It consists of a discharge of blood and detritus, which comes from the uterus, and is probably due to a disintegration of the uterine mucous membrane, preparatory for the implantation of the ovum.

After ovulation has been established, the ovaries assume a nodular appearance due to cicatrices left after the discharge of the ova, and this condition remains till late in life, when they atrophy and present the appearance of short and thickened bands.

Puberty.—As the time for the first menstrual period approaches we find the breasts enlarging, the nipples becoming more prominent, the vagina growing more roomy, and the uterus increasing in size. The pelvis broadens out, the hips and thighs increase in size and become rounder, and

hair begins to make its appearance on the pubes. This is puberty, which indicates the time about which impregnation first becomes possible.

Relation of Ovulation to Menstruation.—The relation of menstruation to ovulation has often been discussed, and is still an unsettled question, but it can be asserted with certainty that menstruation is due to ovulation, while the latter is independent of the former. Conception may take place in girls, before the menses have made their appearance; in nursing women, while they are absent, or in females after the establishment of the menopause. In all women, however, with few exceptions, a suppression of menstruation is established very soon after the removal of both ovaries.

The age at which conception becomes possible varies greatly in races and individuals. In Persia menstruation is established by the ninth to tenth year; in Syria by the tenth to eleventh year; and on the Guinea Coast by the eighth or ninth year.

Taylor reported a case of conception in a girl of 12 years: Molitor, one in a girl of 9 years 5 months; Rüttel, one in a girl of 9 years; and Kussmaul one in a girl of 8 years. I have met with a case of twins in a girl of 13 years, and I have had reported to me, on pretty good authority, the case of a Damascus Jewess who became a grandmother at 21 years.

Maturation of the female is early in hot, and late in cold countries. Rich food also stimulates, while insufficient or poor nourishment retards it. Girls nurtured in cities, where it is hot and the mental excitement is great, mature at an earlier age than their country cousins. Heredity is a most important factor in this connection, and it

is not uncommon to know of many successive generations developing at an early age.

Menopause.—The menopause is established between the 46th and 50th years, at which time we see something of a return to the masculine type—the voice becoming harsher, the breasts undergoing atrophy, and more or less hair appearing on the chin and lip. Those influences which have been mentioned as affecting the establishment of menstruation affect also the establishment of the menopause. The length of the child-bearing period is pretty definite, for where puberty is early the menopause will be early, and *vice versa*.

A few remarkable cases of child-bearing at an advanced age have been recorded. Rush reported one in a woman of 60 years; Dewees, one in a woman of 61 years; Haller, one in a woman of 70 years; and Thibaut de Chauvalon reported one in a woman of Martinique of 90 years.

Copulation.—During copulation, in most of the lower vertebrata, the relative position of the two participants is back-to-belly, the part played by the female being passive throughout; but in man she is more of an active agent, this being rendered possible by the belly-to-belly position. This position also brings the most sensitive parts of the genital organs of each sex in contact. The engorged and sensitive clitoris is drawn down by muscular action so as to come in contact with the penis, while the corona glandis of that organ causes friction against the roughened folds of the anterior vaginal wall.

In many married women, and some virgins, I have found that that part of the anterior wall of the vagina situated just behind the symphysis pubis, is as sensitive as, and in some cases more sensitive than, the clitoris. As friction is con-

tinued all of the female organs of generation become engorged with blood, and muscular action is excited. The uterus enlarges, becomes more cylindrical, and straightens out the axis of its canal. Its external os becomes dilated and round, while the plug of mucus normally closing that opening is expelled. With these changes we have a slight descent of the uterus towards the ostium vaginæ, while it is tilted back nearer the sacrum, so as to bring the utero-vaginal axis closer to a right line. When orgasm approaches the contents of the vulvo-vaginal glands is discharged in jets, and the vagina and uterus take on a rhythmical contractile action, which probably assists the entrance of the seminal fluid, as it is ejaculated over the cervix, into the uterine cavity. It is not improbable that the uterine terminations of the Fallopian tubes may also be opened by these rhythmical contractions of the uterus. On more than one occasion I have satisfied myself as to the existence of this uterine action, when making a not over-careful digital examination of very amorous females. In examining a woman with prolapsus uteri, J. Beck noticed that the os uteri, during sexual excitement, opened and closed convulsively, five or six times, after which it became firmly contracted. This rhythmic action has been observed by Brundell in the vaginæ of rabbits, while in heat.

Seminal Fluid.—The seminal fluid, as it leaves the penis, is composed of secretions of the testes, the prostate, and Cowper's glands, with a small quantity of mucus derived from the urethra. If examined under the microscope many different objects are seen, but the moving spermatozoa, only, are necessary for impregnation. These progress, according to Lott, at the rate of 36 millimetres a minute. Mayrhofer claims that for

impregnation it is necessary that the spermatozoa be deposited, during coitus, in the cervical canal where the reaction is alkaline. Sims found that they died in the vaginal secretions within twelve hours, but in the cervical canal he found them alive forty hours after intercourse, and Percy reports a case where he found them alive as long as eight and a half days after coitus. The cilia in the upper part of the cervical canal may assist them in entering the uterus, but their passage through the Fallopian tubes is due to their inherent mobility, as the cilia of the tubes move in an opposite direction.

Impregnation.—The seat of impregnation is difficult to settle. In the lower animals it is known to frequently take place in the Fallopian tubes, and the frequency of extra-uterine pregnancy in woman leads us to infer that it may take place in both the tubes and the ovaries. Löwenthal advances the hypothesis that about every four weeks an unimpregnated ovum passes to the uterus and becomes imbedded in the mucous membrane, where it is impregnated or degenerates. If this hypothesis were true, extra-uterine pregnancy would be almost unknown.

Impregnation consists in the entrance of one or more spermatozoa into the substance of the ovum.

In the ova of the lower animals, where observations can be made with facility, the presence of only one spermatozoon has been recorded, but several spermatozoa have been observed in the ovum of the rabbit. Keber was the first to record, in the ova of the fresh-water muscle, an opening, or microphyte, for the entrance of the male element. This has been observed in the ova of other animals, and the ova of some of the lower orders has the power of throwing out processes, or pseudopodia, with which they seize

and draw in the spermatozoa, but none of these phenomena have been observed in the mammalia.

Passage of Ova to Uterus.—The old theory of the fimbriated extremities of the tubes applying themselves to the ovaries so as to receive the ova, is now known to be only partially true. In many animals the distance between the extremities of the tubes and the ovaries is too great to permit of this. It is now a well established fact that the motion of the cilia in the tubes creates a slow current of fluid in both tubes and peritoneal cavity. Oldham, Rokitsansky, Scanzoni and others have recorded cases where the serum passed from the ovary of the one side into the tube of the opposite side. This was proved by the absence or closure of the tube on the side where the corpus luteum existed.

Of four rabbits from which Leopold removed the ovaries of the one and the tubes of the other side, two subsequently became pregnant.

When the impregnated ovum reaches the cavity of the uterus, it is arrested by the folds of the mucous membrane, becomes attached and begins to grow, but if it should fail to become impregnated it degenerates and is cast off.

Necessary Conditions for Impregnation.—For reproduction, then, three conditions are necessary, viz.: 1. A production of healthy ova and spermatozoa; 2. The union of the ova and spermatozoa; 3. The implantation of the impregnated ovum in a uterus fitted for its development. All influences acting, directly or indirectly, so as to prevent the fulfilment of one or more of these conditions, will produce sterility.

CAUSES.

1. *Non-production.*—Non-production of healthy ova and spermatozoa may be caused by (a) ab-

sence, non-development or malposition of the genital glands; (*b*) inflammatory troubles producing atrophy or destruction of those organs; (*c*) tumors or new growths affecting the nutrition of, or directly invading, the gland substance; and (*d*) all influences which affect the glands indirectly by altering the general condition of the body.

In all barren marriages where symptoms of uterine disease are not well pronounced, we should first make a microscopical examination of the spermatic fluid. This can be easily obtained by withdrawal of the organ as orgasm approaches, or by collecting the fluid, by means of a small syringe, from the vagina after the act has been completed. The best method, however, is the use of a condom during coitus.

Male.—The quantity of the seminal fluid depends on the size of the testes and the habits and physical condition of the male. Sims places the average quantity at about 2 drachms. It is not the quantity, however, but the quality, that concerns the physician, for though there may be a normal quantity of fluid discharged, the spermatozoa may be entirely absent—azoospermia.

Should there be no discharge—aspermia—it is useless to look for spermatozoa, but they may exist in large quantities and in a perfectly healthy condition when only a small quantity of fluid is discharged. Either of the above conditions may be congenital or acquired. The congenital variety, as a rule, is permanent, but the acquired form is either permanent or temporary.

(*a.*) In the congenital variety there is an absence or imperfect development of the testes, which prevents the production of the spermatic fluid. The absence of one testis—monorchism—is of little moment, but the absence of both

testes from the scrotum—cryptorchidism—generally indicates sterility. This, though, is not always the case, for one or both testes may exist in the abdominal cavity and be in a healthy condition.

(*b.*) The most common cause of the acquired form is orchitis, due to external injury, mumps, gonorrhœa, syphilis, or other troubles in which an atrophy of the glandular elements is caused by the inflammatory process.

(*c.*) Hernia, hydrocele, varicocele, and all benign tumors disturb the nutrition of the testes by pressure or by dragging on the blood-vessels, and thus produce atrophy. Cystic diseases, tubercle and malignant tumors destroy the testis by a direct invasion of its glandular structure.

(*d.*) All fevers and inflammatory or wasting diseases affect the testis temporarily by impairing the general health. The sterility due to excessive venery, masturbation, and affections of the nervous system, is usually temporary, but may become permanent through organic changes taking place in the testes. Heredity, consanguinity, and many other agencies affect the reproductive organs of the male, but in exactly the same way in which they affect those of the female. At what time senile sterility is established in the male is not definitely known, but as his development is less rapid than that of the female, so is his loss of power postponed till later in life. In temperate climates the reprocreative power may be established as early as the 14th year and be maintained, in persons of robust constitutions, as late as the 70th, 80th and 90th year.

Female.—(*a.*) The ovaries may be, one or both, congenitally absent or imperfectly developed. The absence of one is of little importance, for the other,

if healthy, is sufficient to furnish ova for impregnation.

Congenital absence or defect of both ovaries is generally accompanied by other abnormal conditions of both the internal and external organs of generation. Many interesting cases of this kind are found in all works on gynecology. Prolapse of the ovaries may affect their nutrition and set up inflammatory changes which result in atrophy and destruction of the Graafian follicles.

(*b.*) Aristotle seems to have been the first author to point out the fact that early marriages are a frequent cause of sterility, and the statistics collected by Duncan and Kisch show conclusively that not only is sterility more frequent, but the birth of the first child is postponed longer in those marriages where the woman is 15 to 19 years of age than where she is 20 to 24 years of age. This is due to inflammatory changes caused by injury during coitus or at childbirth, to imperfectly developed genital organs. The researches of Slavjansky have shown that inflammation, with subsequent atrophy of the Graafian follicles, may occur in rickets, scrofula, tuberculosis, pneumonia, typhoid fever, and all inflammatory and wasting diseases. In both acute and chronic ovaritis there may be an absorption of the follicular contents, followed by a collapse and adhesion of the follicular walls, which results in atrophy of the ovaries. It is in a different way that pelvic peritonitis acts. Here, the inflammatory products thrown out contract, and both dislocate and compress the ovaries so as to disturb their blood supply. Syphilis causes atrophy, directly, by affecting the ovaries, and indirectly, by setting up peritoneal inflammation.

(*c.*) All new growths of the ovaries—cystic (follicular, multilocular, dermoid, papillary and

myxo-polypoid), and solid (papilloma, fibroma, fibromyxoma, sarcoma, carcinoma and enchondroma) induce sterility by destroying the structure of or producing atrophy of the ovaries. As long, however, as a healthy portion of the ovary remains, conception is possible. Schröder took advantage of this in operating, and would always leave a piece of healthy ovary when it was possible. The possibility of spayed sows getting with pig has long been known to stock-raisers, and I have seen several examples of it in my own neighborhood. Schatz reported a case where a young woman of 20, on whom double ovariectomy had been performed, conceived. In all of these cases a part of the ovary must have been left, or it may be that a supernumerary or accessory ovary existed, as in cases reported by Biegel, Klebs, Olshausen, Winckel and others. In the female, as in the male, varicocele may exist, about the organs of Rosenmüller, and produce atrophic changes by disturbing the circulation of the ovaries, but this affection is exceedingly rare.

(*d.*) In females suffering from diabetes, anæmia, chlorosis, and chronic affections of the nervous system, conception is rare, because of lack of sufficient energy to produce healthy ova. It is probably in the same way that the excessive or long continued use of alcoholic stimulants, opiates and other drugs prevent conception. The causative influence of obesity in producing sterility is very doubtful. It does not prevent the production of healthy ova, but indicates a lack of vigor and a sluggish condition of the general system unfavorable to ovulation. The ova are discharged periodically about once a month, and it is about that time that impregnation is most apt to occur. Of 248 cases, in which the time of copulation was definitely known, Hasler found that conception

took place in 86 per cent. during the first ten days after the cessation of the menstrual flow. Capellman advises sexual abstinence for fourteen days after the cessation of, and three or four days before the appearance of the menstrual flow, if one desires to avoid conception. The Jews, the most prolific of all people, allow five days for the menstrual flow and to this add seven days, making in all twelve days, from the first appearance of the menses, during which coitus is forbidden.

The season of the year also affects conception, and we find it occurring much more readily in spring and summer than in autumn and winter. Haycroft, who has carefully studied the subject, finds that in Scotland the number of women who conceive increases with the rise of temperature.

The quantity and quality of the food materially affects conception, it being a well known fact that more children are born during years of plenty than during famines. Women in moderate circumstances, however, are more prolific than those who live in luxury and idleness. Hensen points out the fact that melons and cucumbers are more productive when raised in the shade and furnished with moisture than when exposed to the sun and a dry heat, and argues that women are affected, to a certain extent, by the same causes.

We saw that this was so when speaking of food and temperatures, and it is even more noticeable in the lower animals than it is in man. Pigeons are much more prolific when well housed and liberally fed than when they are allowed to look out for themselves. Indoor confinement or change of long established habits will tend to cause sterility in both the lower animals and in man. All showmen know that wild animals are remarkably unproductive when deprived of their accustomed freedom.

In France it has been shown that of eggs laid by uncooped hens only 20 per cent. are sterile, but this figure rises to 60 per cent. when they are closely confined. Darwin calls attention to the fact that mares rarely get in foal just after being taken from the stable and turned to pasture.

In what way consanguinity acts in causing sterility is not known, but it is a common cause in both the lower animals and man. Interbreeding of stock will cause the most improved breeds to degenerate in a very short time, and in families we see the same result, the progeny becoming sterile, deformed or mentally deficient. Mitchell points out the fact that this can be partly averted by good food and hygienic surroundings.

Galton, who has studied the question of heredity in all of its bearings, more thoroughly than any one else, finds that it is a potent factor in producing sterility. In England, where only-child sterility is as frequent as one in every thirteen marriages, Susell finds heredity one of its chief causes. The absence of menstruation has been given by some authors as a cause of sterility, but this cannot be, for it only indicates a condition of the ovaries unfavorable for ovulation, and should be considered as a symptom. When it exists up to the 20th year, it is usually a sign of non-development or atrophy of some of the internal organs of generation. From the forty-sixth to the fiftieth year it usually becomes permanently established and indicates the presence of senile sterility. The menses may also be arrested by catching cold, by fright, or by any great physical or mental excitement, and generally indicates a condition unfavorable for conception.

2. *Non-union*.—Non-union of healthy ova and spermatozoa may be caused by (a) absence, stenosis, atresia or dilatation of any part of the

course traversed by the human germs; (*b*) by diseased conditions of the passages which tend to impair the vitality of either ova or spermatozoa; (*c*) by artificial means employed to prevent conception; (*d*) by all influences tending to hasten, prevent or retard orgasm.

Male.—(*a*.) The possible existence of the ovaries, with the absence or imperfect development of one or all of the remaining internal organs of generation—those developed from the Wolffian bodies and the conduits of Müller—is well known, and it is but reasonable to suppose that the corresponding portions of the male genital tract—the ducts from the testes to the urethra—can also be absent or undeveloped while the testes are present. Such a condition must prevent the entrance of semen into the urethra.

Dunley found that in old age an obliteration of the ducts took place, probably before the testes ceased to generate spermatozoa. Pressure from tumors of the cord may also cause occlusion of the ducts. Epispadias, hypospadias and urethral fistula, unless situated near the glans penis, will allow the escape of the semen before it enters the vagina, and in those cases where it is deposited in the vagina it fails to be ejaculated against the cervix.

Stricture of the urethra is a very common cause of sterility. When narrow and situated in the anterior portion of the urethra, it obstructs the canal during erection so as to dam up the semen till the organ becomes flaccid, when it gradually oozes out. Should the stricture be situated far back, a regurgitation of the fluid may take place into the bladder, and be passed only as the urine is voided. When a slight stricture is present, impregnation may be affected by a change in the normal spiral direction of the urethra. This, as

a rule, twists from right to left, as can be seen when passing urine from a healthy urethra, and it can also be demonstrated by passing a large olivary bougie well back into the canal and withdrawing it by a small thread attached to its end. In connection with this it is interesting to note what Courty says, in speaking of the "arbor vitæ" of the cervical canal. "The posterior tree," says he, "deviates to the left in proportion as it approaches the superior orifice. The anterior tree is, on the contrary, directed towards the right." It will be observed, then, that when the meatus urinarius is applied to the external os uteri, the spiral is continuous to the cavity of the uterus. Phimosis and stenosis of the meatus urinarius have the same effect as stricture, and a too large meatus acts in the same way as hypospadias.

(b.) Levy has shown that catarrhal secretions, when containing many pus corpuscles and much epithelial detritus, destroy the vitality of the spermatozoa in a very short time, but it is not probable that urethritis, simple or specific, will directly cause sterility in many cases, as it is such a short time in contact with the spermatic fluid. I recall a case in my own practice in which impregnation and gonorrhœal infection, in all probability, took place from the same individual at the same time.

(c.) Little need be said about the artificial means used by the male to prevent conception. The practice of "withdrawing" as orgasm approaches and the use of the condom are only too well known to all classes, both married and single.

In some parts of France and Syria, the prostitutes adopt a practice not generally known in America. It consists in tightly compressing the male urethra in front of the prostate, as orgasm

approaches, so as to cause a regurgitation of semen into the bladder.

(*d.*) Many men of excitable dispositions, when first beginning to gratify the sexual appetite, are unable to control themselves and have a premature emission, sometimes even before entrance into the vagina has been gained. One individual under my care, who has since married and begat children, would have a seminal discharge as soon as his limbs came in contact with those of a female, even when sitting at meals.

Different neuroses of the genital tract may retard or prevent orgasm, and in one case which came to my notice I had reason to believe that spasmodic stricture of the urethra caused seminal regurgitation into the bladder. These neuroses are found in persons who have been addicted to excessive venery or to masturbation, and in those who have suffered from frequent or long-continued nocturnal emissions. In all debilitated individuals, from any cause whatever, or in those suffering from affections of the nervous system, the reflex centres governing the ejaculatory act may lose their excitability, so that, though erection takes place, there will be no discharge of semen. It is a not uncommon complaint of sterile women that they feel no discharge from the man during coitus. Non-erection prevents orgasm, and this may be caused by physical or mental affections. In some cases a too rapid flow of blood through the dorsal veins of the penis may bring this about.

Female.—(*a.*) Congenital defects, preventing the union of the ova and spermatozoa, may be found in any part of the female genital tract. Kisch calls attention to an abnormal thickness of the tunica albuginea as an obstacle to the escape of the ova, and Schenk has seen the cellular covering of the zona pellucida, as it escapes from the

Graaffian follicle, act as an obstacle to the entrance of the spermatozoa, in rabbits.

Should the outer portions of the conduits of Müller, one or both, fail to develop, or their blind extremities neglect to open, there may be an entire absence or a rudimentary development of either or both of the tubes, or it may result in a closed termination where the fimbriated extremities should be. If an imperfect fusion of the lower portion of the conduits of Müller take place, it will result in some abnormal shape in the body of the uterus, but this does not prevent conception, nor does the imperfect condition arising from lack of development of one of the conduits of Müller.

The septum dividing the conduits may persist in all or any part of its course, and cause the formation of a double uterus or double vaginæ, but this is an impediment to impregnation only when it prevents copulation—conception being possible in either or both sides of the uterus. Should the conduits fail to develop or should they be arrested in their growth, the result will be an absence or malformation of both, either, or any part of the uterus or vagina, and any of these conditions may exist in females who are apparently well developed.

Examples of entire absence of the uterus are quite numerous, its diagnosis being easily made, on the living individual, by introducing the finger of one hand into the rectum and a probe, catheter, or finger of the other hand into the bladder.

Total or partial absence of the vagina may exist when the uterus is present or when it is absent, and this abnormal condition can be diagnosed in the same way as the abnormal conditions of the uterus. Should only the lower portion of the vagina be absent, it does not necessarily cause

sterility, for the genital canal may open into the urinary or intestinal tracts, and there are cases of this kind on record where impregnation took place through the anus or the urethra. If, during foetal development, the free edges of the hymen unite so as to entirely close the opening to the vagina, sterility must result. In all other anomalies of the hymen impregnation is possible, though the penis may not gain access to the vagina, and many cases of impregnation without penetration have been recorded, the spermatozoa having found their way through the opening into the cervix uteri. Congenital malformations of the vulva are also found occasionally, in which coitus is impossible. It may be abnormally small, or there may be adhesion of either the labiæ majoræ or the nymphæ. This union may be simply between the epithelial surfaces and easily overcome by traction, or it may be firm and require operative interference.

A small vagina, as a rule, is not a serious drawback to conception, and Kisch calls attention to the fact that small women with large husbands—presumably where the fit is tight—are more prolific than where the two are of the same size, or the woman is larger than the man. The above statement is borne out by my own observations. Congenital atresia of the cervical canal may exist in any part or all of its course. If situated only at the external os, as is most frequently the case, it usually consists of a continuation of the mucous membrane across that opening, and is easily remedied, but when more extensive it is difficult to treat. It usually attracts attention about puberty by the formation of a hæmatometra. Acquired atresia of the cervical canal is quite a common occurrence in women after they have passed the menopause, but here it is usually at the in-

ternal os, and is due to adhesion following degenerative changes.

Stenosis of the cervical canal may occur at either the external or internal os, and can be determined by the failure, in any uterus of normal position, to pass a good-sized uterine sound with ease. Olshausen calls attention to the fact that in women who bear their first child long after marriage a second birth follows close on the first, and he accounts for this by the stenosed os becoming larger after the child has been born. A lady of my acquaintance was barren for six years after her marriage, since which time she has given birth six times in nine years. Stenosis of the cervix is a common cause of sterility, not only in man but also in the lower animals. The Arabs use the hand and various hard instruments for dilating the cervical canal in mares that are unfruitful, and the Tyrolese incise the cervix of barren cows, in both cases, it is said, with successful results. The intra-vaginal portion of the cervix may be abnormally short or entirely absent, and in either case may cause sterility by preventing the application of the glans penis to the cervix uteri. Hypertrophy of the vaginal portion, if general, results in an elongation of the cervix, which is so great in some cases as to prevent coitus. This great length is exceedingly rare, but moderate elongation is quite common, and causes the cervix to be displaced as the seminal discharge takes place. If the hypertrophy is confined to one side it results in flexion, so that the os is tilted towards the vaginal wall during coitus. The conical and the nozzle-shaped cervixes indicate an abnormal condition of the muscular structures, and probably prevent an active participation of that part of the uterus in the act of coition.

Where the cervix is torn or everted, sterility may be caused by the granulations closing the canal so as to prevent the passage of the spermatozoa, by the cervix allowing the escape of the semen after it has entered the canal, or by a catarrhal condition of the lining membrane causing a change in the normal secretion which is unfavorable to the life of the spermatozoa. A lacerated perineum also favors the escape of the semen and promotes secondary changes in the internal genital organs unfavorable for reproduction.

All uterine displacements, whether from a relaxed condition of the ligaments, from increased weight or external pressure, or from the contraction of inflammatory deposits, tend to prevent the entrance of semen to the ova.

In inversion of the uterus conception is necessarily impossible, and next to this versions are most certain to produce sterility, for not only is the cervix tilted out of the way but the os is covered by the vaginal wall as with a lid. In flexions the obstruction is in the canal at the point of greatest convexity, but this is somewhat overcome by the congestion and erection taking place during coitus.

In prolapse, unless complete, there is nothing to prevent conception except the debilitated condition of the uterus and vagina, for the penis naturally pushes the organ back towards its normal position as it comes in contact with the cervix.

Hervey relates an interesting case of procidentia uteri where coitus took place through the dilated cervical canal and was followed by conception.

As the uterus becomes displaced it draws upon and displaces the tubes to a certain extent, and in this way the entrance of semen into their

uterine extremities or of the ova into their fimbriated extremities may be retarded.

Displacements may also prevent conception by producing congestion and thickening of the lining membrane of both the uterus and the tubes so as to occlude these channels.

Contracted pelvis may also prevent the union of ova and spermatozoa by hindering coitus, and Hofmann has recorded an example of this kind where connection was impossible.

Atresia or stenosis of any part of the genital tract may be brought about by inflammatory trouble. All pelvic inflammations—salpingitis, ovaritis, peri-metritis, para-metritis, etc., properly included by Dr. Georges Apostoli under the term “salpingo-ovaritis”—originate almost always in the uterine mucous membrane and spread from there, through the tubes, to the surrounding organs where inflammatory products are thrown out, the contraction of which results in a dislocation of the uterus, of the ovaries, or of the tubes, or in a closure of the lumen of the tubes. The lining membrane of the tubes also becomes thickened and when closure takes place in two or more places so as to prevent the escape of the secretions into the uterine or peritoneal cavities there results a hæmato-, hydro-, or pyosalpinx.

Inflammation of the fimbriated extremities is quite common, and a dropsical condition may be found which causes an obstruction to the entrance of the ova into the tubes. In a case of laparotomy where I removed the right ovary the end of the tube was found inflamed, adherent to the ovary and closed, but it was healthy in all the rest of its course.

Tubercular disease may attack the tube, but the most common cause of salpingitis is an endometritis of gonorrhœal origin.

Acquired stenosis or atresia of the cervix may follow injuries during labor, or it may be due to syphilitic ulceration. In follicular endo-cervicitis the canal may be entirely closed by the enlarged follicles, or ulceration and contraction may take place, thus causing atresia or stenosis and preventing the entrance of the semen.

The application of the sharp curette or of too strong medicinal applications may bring about the same results through cicatrization. Vaginal stenosis or atresia may be due to injuries during delivery or to syphilitic ulceration. Diphtheria may also cause sloughing and subsequent contraction. Simpson has seen simple vaginitis in children result in stenosis, due to an epithelial denudation with subsequent adhesion of the vaginal walls.

Vaginismus is a hyperæsthetic condition of the genitals, usually in virgins, causing a spasmodic contraction of the muscles of the perineum and vagina. It may be due to the small size of the vagina, to ulcers and fissures, to irritability of the hymen, and to organic disease of the uterus. Winckel reports cases in which subperitoneal fibroids seem to have been the cause of it, and Martin gives cold as one of the causes. In many cases self-abuse in childhood seems to have produced a congested and hyperæsthetic condition of the parts. This was the only cause that I could find in a married lady of nineteen, who had been married for nine months without ever having had connection. The hymen was elastic and normal in appearance, but when any attempt was made to introduce the finger into the vagina, intense pain was experienced and a splastic closure of the sphincter vaginæ would occur.

E. Davis reported an interesting case where he was sent for by a gentleman to separate his

coachman and maid, and this could only be accomplished after chloroform had been administered to the woman. The liberated organ showed that there had been a constriction at the sphincter and one higher up in the vagina.

Hypertrophy or new growths of any of the external genitals may be an obstacle to coitus and thereby a cause of sterility.

The clitoris may be so developed as to prevent the access of the male to the female. Hyrtl states that in certain of the African tribes the size of the clitoris is so great that it is fastened to the perineum by rings so as to act as a protection to virginity. It was most likely on account of its size that circumcision was formerly practiced in certain parts of Egypt, and is now in parts of the Turkish dominions. Elephantiasis of the vulva is sometimes a cause of sterility, and hypertrophy of the nymphæ is said to be a frequent cause among the Hottentots, Bushmen and Abyssinians. A large accumulation of fat on the pubes and around the vulva is a not infrequent cause of sterility in persons of somewhat advanced age. Benign and malignant growths of the perineum will prevent the introduction of the penis into the vagina. In a girl of 16 years, from whom I removed a large angioma of the right labia majora, coitus would have been almost impossible.

The vagina may also be so obstructed as to prevent the union of the ova and spermatozoa. This may be caused by cysts, fibrous tumors, polypi, and malignant tumors of the vagina; by pressure from ovarian or rectal tumors; or by cystocele, rectocele, or enterocele. Kisch reports a case in which a mass of hardened fæces in the rectum prevented coitus, and Schulze had a case in which the perineum of a 14 year old girl was

developed to such an extent that the urine was passed with difficulty.

Tumors of the uterus may prevent conception by occluding either the os uteri or the openings of the tubes; they may also cause displacement of the ovaries and tubes, and when very large they may draw the uterus up so as to be out of reach of the glans penis. Indirectly uterine tumors may cause congestion or inflammation of the genital tract producing a condition unfavorable to the passage of the spermatozoa.

Hennig has recorded an interesting case in which hydrocele seems to have been the cause of sterility. Ovarian tumors may prevent the entrance of the spermatozoa either by causing compression or by drawing up the uterus, as in the case of large uterine tumors, and the same is true of tumors of the broad ligaments.

(*b.*) The normal vaginal secretion is slightly acid, and as stated before, unfavorable to the life of the spermatozoa, while that of the cervical canal is alkaline and will preserve their vitality for several days. Should, however, an inflammation of any part of the genital tract be set up, the spermatozoa, as has been shown by Lott, lose their vitality and die in a short time. This may be caused by vaginitis, endocervicitis, endometritis, or salpingitis. It is probable that the ova are also injured by coming in contact with diseased secretions, but on this point our knowledge is not definite.

There are many causes which may produce inflammation of the genital tract, but the most frequent of all is gonorrhœa. Nöggerath thinks that "latent gonorrhœa" is the cause in 90 per cent. of all cases of sterility. This figure seems too high, but it may be correct for the inhabitants of large cities.

Diseased conditions of the genital tract produce sterility more frequently by offering a mechanical obstruction to the entrance of the sperm, or by rendering the endometrium unfit for the implantation of the ova than by destroying the vitality of the germs.

Urinary and fæcal fistula of the genital tract prevent conception not only because of the sense of disgust connected with them, but also by producing a diseased condition of the mucous membrane.

(c.) Among the artificial means used by women to prevent conception may be mentioned sponges and tampons of cotton introduced into the vagina against the cervix. Small rubber caps are also used by placing in the vagina so as to fit as a cap over the cervix uteri and thus prevent the entrance of semen into the cervical canal. Other means are used to destroy the vitality of the spermatozoa. Among these may be mentioned injections of hot and cold water, and solutions of vinegar, alum, boracic acid and other medicinal substances. These methods are not as sure and much more injurious than the former. Abstinence from coitus for fourteen days after the last menstrual period and for three or four days before the appearance of the next flow is also a pretty safe practice, there being no ovum in the tract at that time.

The sexual desire in the male is much stronger than it is in the female, and in some females it is entirely absent. I have questioned many women on the subject and have frequently been told that it was months, and in some cases years after marriage before they could look on sexual intercourse with any feeling but disgust. This has been told me so often that I am inclined to think that the desire among the more highly educated women

is educated and not natural. This also accounts for the fact that the first birth among the better classes is postponed longer than among the laboring classes. Most likely this is due to the development of the cerebrum at the expense of the cerebellum, and in time it is possible that the better class of Americans may become extinct, as have the cliff-dwellers, in whom, judging from their crania, the "organ of philoprogenitiveness" was poorly developed. Many women claim to be able to tell the exact time at which impregnation occurs, and there seems to be good grounds for accepting these statements as true. This is probably due to the perfect orgasm taking place in both parties at the same time. I have ascertained from many prostitutes that though they go through all the motions, when having intercourse, they allow orgasm to take place only when they are with their lovers. To this cause they ascribe the fact of not becoming pregnant and also of retaining their health for a long time. A married woman, whose husband is now suffering from syphiloderma, informs me that she has escaped contracting the disease by not allowing her passions to be aroused, and by bearing down and forcing out the seminal fluid after the act has been accomplished.

We see then that orgasm is more or less under the will-power, so that it can be hastened, retarded or kept in abeyance. It is also affected by all influences which debilitate the body or the nervous system. All agents then which tend to prevent complete and simultaneous orgasm in the two individuals are causes of sterility.

3. *Nonimplantation*.—Nonimplantation of the impregnated ovum in a healthy uterus may be due to disease of the tubes or of the uterus. After the ovum has become impregnated, most likely

in the outer part of the tubes, it is carried by the current in the tubes, which is caused by the motion of the ciliated epithelium and which is probably assisted by a peristaltic action of the tubes, to the uterus. The uterus is also lined with ciliated epithelium whose motion is towards the tubes. This motion probably assists the entrance of the spermatozoa into the tubes and also acts as an impediment to the downward passage of the ovum. We have seen before that ovulation and menstruation are closely connected, so that by the time the ovum has reached the uterine cavity the endometrium has become swollen and its outer layer, at least, has been thrown off as detritus so as to offer a suitable nidus for the ovum. Here, if all is favorable, the impregnated ovum becomes attached and remains, undergoing development, till normal delivery takes place.

The frequent arrest of the ova in the tubes is shown by the number of cases of ectopic gestation. Mr. Tait claims that all cases of extra-uterine pregnancy are primarily of tubal origin. He admits the possibility of ovarian pregnancy, but denies that it is possible to have a case of primary abdominal pregnancy, and his assertions are borne out by recent investigations.

The arrest of the ovum in the tube may be caused by peritoneal or cellular inflammation, in which a constriction is brought about by the contraction of the inflammatory products; by pressure from tumors and new growths; by catarrh and swelling of the lining membrane, which may also affect the ciliary motion of the epithelial lining or the peristaltic motion of the tubes, and by pouches or dilatations in the tubes where the action of the current is lost.

The uterus may be sufficiently developed to receive the ovum and yet be unsuitable as a seat

for future development. An arrest of growth may take place in foetal life, before the uterus and vagina have become differentiated, giving the "uterus foetalis," or its growth may be arrested in infancy while the cervix is very long and the body undeveloped, which results in "uterus infantilis," which, according to Biegel, is as frequent in cases of sterility as 4:155. Winckel has shown that foetal inflammation is a frequent cause for non-development of the uterus. Atrophy of the uterus may also be acquired, as in the condition known as "primary atrophy," which occurs in girls before the period of puberty, when they suffer from wasting constitutional diseases, from anæmia or from chlorosis. In weak mothers, who have suffered from puerperal complications, it is not uncommon to find the menses suppressed and the uterine walls in a thin and flaccid condition. This is known as "puerperal atrophy" of the uterus. A condition of the uterus which is unfavorable for implantation or development of the ovum may be brought about by inflammation of the peritoneum and cellular tissue surrounding the uterus; by inflammation of the uterine parenchyma, or by inflammation of the endometrium.

Peri- and para-uterine inflammations may spread to the uterine tissue itself, but most frequently they contract and produce displacements of the uterus or bind it down so that when the ovum enlarges abortion follows. They may also prevent the return of the venous blood from the parenchyma of the uterus, which results in hyperplasia, with a subsequent catarrh of the endometrium. Hyperplasia may also be produced by disturbances of the circulation due to valvular disease of the heart, but it most frequently follows the first birth and is caused by subinvolution.

The constant excitement due to excessive venery results in hyperplasia, and we find flexions producing the same results, but by arresting the return of the venous blood.

In all cases of hyperplasia the endometrium is found congested and the secretion from its glands, and the glands of the cervix, much more profuse and watery than when in a normal condition. It is probably in this way that hyperplasia acts, for in many cases where the endometrium is not too much diseased pregnancy occurs in spite of the thickened uterine walls. Hyperplasia may run into chronic metritis where true inflammatory products are thrown out, and this will prevent the development of the ovum even though it become attached.

As stated above, the inflammations around or within the uterus may extend to the muscular tissue proper, in which condition we find hæmorrhages from the endometrium quite common, and in this way the ovum, after having reached the uterine cavity, may be washed out. The cavity of the uterus also becomes larger than normal so that there is less chance for the arrest of the ovum, the nutrition of the endometrium is more or less disturbed so that implantation of the ovum is not likely to take place, and the irritability of the nerve supply is favorable to uterine contraction, which frequently results in the expulsion of the ovum.

Inflammation of the endometrium is the most frequent, directly or indirectly, of all causes in producing sterility. We have seen how it may produce changes which prevent the entrance of or are injurious to the vitality of the spermatozoa.

We have also seen how most para- or peri-uterine inflammations start from the endometrium, and either affect the production of the ova or pre-

vent their union with the spermatozoa. It now remains to consider how inflammations of the endometrium may prevent the implantation of or development of the impregnated ovum. In endometritis there is a production of many small round cells which are deposited between the glands, so that compression of the glands takes place and results in atrophy, not only of the glands, but also of the mucous membranes. With this the secretion becomes thin and watery and its reaction is altered, while the ciliated epithelium is thrown off and replaced by cylindrical and polyhedral epithelium. This gives a smooth and slick condition to the endometrium so that the arrest of the ovum in the uterine cavity is very difficult, or, should it be arrested and become implanted, the atrophied condition of the mucous membrane with the alterations in the subjacent tissues will favor its early expulsion.

All intra-uterine growths, whether submucous fibroids, polypi, malignant or other tumors, prevent implantation or favor early abortion by altering the condition of the mucous membrane, or by offering a mechanical resistance to the development of the ovum.

Growths in the muscular tissue also alter the condition of the mucous membrane, but they act chiefly by preventing the uniform enlargement of the uterus as the ovum develops. The subserous growths may produce a condition closely resembling vaginismus and, if impregnation occur, the excitable condition of the nerves may cause early abortion. Intra-abdominal tumors may, if large, be an obstacle to the development of the ovum by directly compressing the uterus, as is sometimes seen in cases of multilocular ovarian cysts.

Cancerous tumors act by infiltrating the tissue of the uterus as well as by preventing copulation

through the sense of disgust connected therewith. Should laceration of the cervix extend nearly up to the internal os it causes infiltration of the uterine tissue, which results in a loss of the relation between the ovum and uterus as development progresses, of which abortion is the consequence. Membranous dysmenorrhœa is in some cases a cause for the discharge of the ovum, but not in all cases, for many examples of child-bearing have been reported in women who were suffering from that trouble. Another cause for non-implantation of the ovum, which is probably more frequent than is generally supposed, is the application of the sharp curette or strong medicinal substances to the endometrium by unskilful hands. Their value, in suitable cases, when carefully applied, can not be over-estimated, but if the mucous membrane be destroyed in its entire thickness it must be replaced by cicatricial tissue unsuitable for the implantation of or nourishment of the ovum.

To enter into the subject of abortion would be rather foreign to the present subject, and it would require too much space for the present paper. Suffice to say that where habitual abortions occur, if neither the father nor the mother show any signs of syphilis, attention should at once be directed to the uterus. I have under my care now a lady who has aborted five times, and it was only in her last accident, the first in which I attended her, that a large uterine polypus was discovered. The trouble was supposed to be due to "habit."

TREATMENT.

1. *Nonproduction.* — *Male.* — (a.) Should the testes of the male be congenitally absent from the scrotum there is a possibility of their being present in the abdominal cavity, but in either case if aspermia or azoospermia exists, treatment is useless. Should spermatozoa exist in small quantities the same remedies can be used that are employed in early decay. These can also be used in cases of retarded development.

(b.) Where inflammatory or other troubles have produced destruction of the glandular structure, restoration of the destroyed tissue is impossible; but under iodides and mercurials with counter-irritants and electricity, the inflammatory deposits may be absorbed and the arrested secretion from the remaining healthy portions reëstablished.

(c.) When sterility in the male is accompanied by atrophy or softening coincident with varicocele, hernia, or other benign tumors, the prognosis is good, if the individual will submit to surgical treatment in time. The tumors should be extirpated and the testes injured as little as possible. In all cases of hernia where a truss is not suitable the radical cure should be undertaken. Of all the methods used for varicocele the best is ligating the veins above and below, by the open method, and dividing them between. Hydrocele should be first treated by withdrawing the fluid and injecting irritating substances, after which, if a cure is not effected, more radical measures can be adopted. For malignant tumors, thorough extirpation has to be resorted to and the prognosis is very unfavorable for future posterity.

(d.) If sterility is subsequent to some constitutional disease, attention must be directed to building up the general health. A sea voyage,

a trip to the mountains, sea bathing, or a stay at some chalybeate springs will be found beneficial in anæmic or debilitated persons.

In obese and plethoric subjects the saline springs will be preferable, while a course of laxatives, careful dieting and regular exercise will exert a beneficial influence. Should the cause be traced to masturbation or excessive venery, bromides must be used, while the will power is appealed to and the patient removed as far as possible from all exciting causes.

Debility of the sexual organs can be best overcome by cold douches and electricity, while the phosphides, nux vomica, and cantharides are employed internally.

Female.—(a.) Congenital absence of the ovaries can not, of course, be remedied, and non-development is almost as hopeless, though there is reason to believe that the use of electricity and massage, long continued, may stimulate the development of the glands. Where dislocation of the ovaries depends on uterine displacements it should be treated by attending to the false uterine position. If the ovary alone is dislocated it can frequently be treated by a pessary, unless in the inguinal canal, when it should be replaced and supported by a proper fitting truss.

(b.) Little can be done when atrophy of the ovaries follows wasting diseases, except to use tonics and such remedies as are used in atrophied testes, hoping thereby to cause development of such follicles as have escaped the inflammatory process. Much, however, can be done to prevent inflammatory troubles by preventing early marriages. Women, as a rule, unless well developed, should not marry under twenty years of age, and in many cases it is best to wait until the twenty-second year. In pelvic inflammations,

where exudation has taken place, it is well to withdraw, by aspiration, what fluid can be obtained and thus abort the trouble. Dr. Hardon, of Atlanta, Ga., speaks highly of this treatment, and I have seen the happiest results follow its use. Where due to syphilitic infection the inflammatory deposits must be treated by iodides and mercurials while tonics are given to build up the general health. Where atrophy of the ovaries is due to contraction of inflammatory deposits, which dislocate or compress the ovaries, much benefit can be obtained from the long-continued use of hot water vaginal injections, massage and galvanism. Vaginal and rectal suppositories, containing iodine, iodoform, or one of the iodides, can also be used with advantage. With the local treatment we should also use tonics and such remedies as are best calculated to build up the constitution.

(c.) Where malignant growths affect the ovaries, early and complete removal must be resorted to, but if the growth is benign, the operator should, if possible, leave as much of the ovary as appears to be healthy, in the interest of future generations.

(d.) The sterility attending anæmia, chlorosis and other constitutional affections must be treated on general principles. Tonics, baths, chalybeate waters, voyages, change of scenery and surroundings, can all be used, while good and nutritious food must be furnished and regular out-door exercise enjoined. Where the persons are addicted to the use of drugs they will have to be gradually weaned off and some substitute used till the physical and moral nature is sufficiently strong to enable them to abstain.

In cases of obesity, rich, saccharine, fatty and starchy foods must be forbidden, regular and

daily out-door exercise required, and sea bathing and saline waters advised. In the way of medication aloes, iron, nux vomica, and phosphorus can be employed advantageously. Desprès relates cases where the application of electricity produced sexual excitement with a discharge of vaginal and uterine secretions, and it is more than likely that the same agent will be found of use where non-production of ova is due to a sluggish condition of the female genitalia. Little can be done by the physician in inherited sterility except to pay attention to the general functions of the body, but he should, wherever he can act as the family adviser, impress on his patients the evils of inter-marriage, and do all that he can to prevent such unions.

2. *Nonunion. Male.*—(a.) Any absence or occlusion of the ducts situated between the testes and the urethra is naturally out of reach of the surgeon, unless the occlusion is due to pressure from a tumor of the cord or elsewhere, in which case it can be readily removed. The causes of non-union in the male are fortunately situated, as a rule, in the urethra, and these can generally be remedied. In urethral fistula, epispadias, and hypospadias, the defect can be remedied by a plastic operation. Phymosis, stenosed meatus and dilated meatus can also be easily remedied by simple operations. It is in strictures of the urethra, however, that the surgeon has to employ his ingenuity, and wide differences of opinion exist as to the best methods to employ. Soft stricture usually yields readily to dilatation, but the fibrous stricture should be treated by urethrotomy and electrolysis. Otis, of New York, prefers internal urethrotomy; Stein, of New York, thinks gradual dilatation best; Keyes, of New York, practices external urethrotomy for strictures.

from injuries; Lavaux, of Paris, claims a new method which he calls "divulsion progressive," where a cure can be effected in eight days; and every town of any size now has its ardent advocate of electrolysis. Should the breadth of a fibrous stricture be narrow it may be advantageously excised by external urethrotomy and the two portions of the urethra carefully drawn together and united by sutures.

(*b.*) Though the gonorrhœal poison is one of the most potent factors in producing sterility, yet it probably affects the vitality of the spermatozoa very little as they pass through the urethra. It is well, though, in every case to check the discharge as soon as possible, and for this I have found injections of creolin or of sublimate solutions among the best remedies.

(*c.*) The use of artificial means by the male to prevent conception can not be too severely condemned, for they are injurious both morally and physically. Abstinence from coitus, and coitus only about midway between the two monthly periods are the only legitimate means to be employed, where there is a desire to avoid conception.

(*d.*) In individuals of excitable dispositions, where orgasm comes on before that of the female, bromides can be given, but in time each individual will learn the other's disposition and be able to hasten or delay orgasm till the proper moment. If this is not accomplished in a reasonable length of time, it may be well to separate the parties for a longer or shorter period, at the end of which time the difference in disposition will probably not be as great. Where neuroses of the genital tract exist there will generally be found some tenderness, or it may be a stricture of the urethra. In either case attention must be directed to the

seat of the trouble. If orgasm seems to be retarded by exhaustion of the nerve centres nothing will be found better than phosphide of zinc and nux vomica. Where the trouble seems to be due to a dilatation of the dorsal vein of the penis, subcutaneous injections of ergotin by the side of the vein will be found useful. Jamin, of Paris, reported a case where imperfect erection was cured by the surgical treatment of an accompanying varicocele. Vidal de Cassis reported a similar case and I have succeeded in curing another case by the same treatment.

Female.—(a.) All abnormal conditions of the ovaries and of the ova which prevent the escape of the ova or the subsequent entrance of the spermatozoa are irremediable. So also is absence or imperfect development of the tubes and absence of the uterus. In cases of double uterus operative interference is not called for, nor is it in double vagina unless the septum prevents coitus. Where there is partial or complete absence of the vagina, with a normal uterus present, an artificial vagina can be made by carefully dissecting between the bladder and rectum so as to avoid injury to these organs. In unmarried females tents will have to be used occasionally to keep it from contracting, but after marriage the male organ will usually render the use of the tent unnecessary.

The discovery of an imperforate hymen is usually made at puberty, and is easily remedied by incising, but all antiseptic precautions must be used to prevent septic absorption. Should coitus be prevented by a rigid hymen or an abnormal condition of the vulva, a slight and harmless surgical operation will set all to rights.

Atresia of the cervical canal is best operated on by a trocar, and dilators used afterwards. If

hæmatometra is present the same care must be used as recommended in operating on hæmatocolpas, for septic poisoning is exceedingly easy after the operation. Stenosis of the cervical canal can be treated by incision, or by dilating with instruments for that purpose, but the best and most permanent results are obtained from the occasional use of tents.

For absence or abnormal shortness of the intra-vaginal portion of the cervix there is no remedy. Where uniform elongation or hypertrophy of the cervix exists amputation must be resorted to, but in the operation care should be used to unite the mucous membrane of the cervical canal to that surrounding the cervix so as to prevent subsequent stenosis. In sterility due to stenosis or flexions the "Outerbridge dilator" will be found of service, if introduced several days before the menses make their appearance. Where hypertrophy of the cervix is confined to only one side, amputation can be practiced or the convex portion of the cervix can be incised so as to remove the obstruction. Conical and nozzle-shaped cervixes must also be amputated. In cases of lacerated cervix or lacerated perineum the duty of the surgeon is to repair the injured part as soon as possible.

In all displacements of the uterus an effort should be made to restore the normal position.

Prolapse can be treated by massage, hot douches, astringent tampons, pessaries, supporters, or some of the surgical procedures to be mentioned hereafter. Where flexions exist tents should be used to soften the uterine tissue and straighten out its axis, after which intra-uterine stems, tampons or pessaries should be used to keep it in its normal position. Versions can often be treated by tampons and pessaries, and

Bouilly, of Paris, recently reported eighty cases of retro-deviations treated successfully by pessaries; of this number three had subsequently become pregnant. Should, however, the displacements be of long standing it will be well to resort to surgical interference. Alexander has devised a means of shortening the round ligaments of the uterus, which has been modified somewhat by Polk and Wylie. This operation gives the best results for simple retro-deviations, but it has also been used in prolapse. In the latter case it is best to accompany it by some operation for narrowing the vagina or increasing the perineal support. In a case of prolapse Freund, of Strassbourg, opened Douglas' cul-de-sac and attached the fundus uteri to the peritoneum of the sacrum. This he calls retro fixation. Ventro-fixation consists in opening the abdominal cavity and attaching the uterus to the abdominal parietes. It is steadily growing in favor and has the hearty support of such men as Lucas-Championnière, Polaillon, and Terrier, of Paris; Säger, of Germany; Kelly, of America, and many others. It gives the best results in cases of simple retroversion, but has been used in nearly all displacements. Picqué, following the operation Olshausen, has, where the uterus was bound down, opened the abdomen, divided the bands and attached the uterine ligaments to the abdominal parietes. The result was good, but it might be well to adopt the method of Erich and forcibly separate the adhesions by a large steel sound introduced into the uterine cavity. It seems also that the safety of these operations might be increased by incising only as far as the peritoneum and suturing without opening the abdominal cavity. Contracted pelvis is a rare cause of im-

pediment to the entrance of the semen, and when it is can not be remedied.

Acquired stenosis or atresia of the genital tract must be treated in the same way as the congenital form, and usually gives better results.

The evil results of inflammatory deposits about the uterus and its appendages have been dwelt on in speaking of the causes of sterility. When the acute stage has passed such remedies should be used as will favor the absorption of the deposits. Copious injections of hot water, in both vagina and rectum, are found very serviceable in producing these results, but they must be long continued to produce the best results. Tampons of glycerine with or without iodine, or iodide of potash also exert a favorable influence. Rectal and vaginal suppositories of iodine, iodide of potash, or iodoform have yielded excellent results in my hands, when combined with tonics and hot-water injections.

In some cases local blood-letting will be found serviceable. With all these remedies absolute abstinence from sexual excitement must be enjoined.

Electricity has been introduced by Dr. Georges Apostoli in the treatment of these affections, and its long continued use in chronic and subacute cases has been followed by the most excellent results. Engelmann and many others, both here and abroad, testify to its efficacy.

Major Thure Brandt, of Stockholm, was the first to use massage in uterine affections, after which it was practiced by Dr. Sahlin of the Stockholm medical school. In 1870 Dr. Nosström, of Paris, became interested in the subject, and after carefully studying it introduced it into Paris in 1872, since which time it has been diffused over the whole civilized world.

It has been used for uterine displacements, metritis and ovaritis, but its most satisfactory results have been made in peri-uterine exudates of long standing. Semianikoff, of St. Petersburg, reports favorably of it, as do also Profs. Jackson and Martin, of Chicago, Drs. Smith and Athill, of England, and many others. Boldt, of New York, calls attention to the fact that great care must be used where accumulations of fluid exist in the tubes. To get satisfactory results massage must be carried out by the gynecologist himself, and persevered in for a long time. Only chronic and subacute cases should be subjected to treatment, and where the finger of the operator is not long enough to reach the deposits he may resort to the obturator of Wissenberg, the end of which may be covered with rubber if much tenderness is experienced.

When hydro-, hæmato-, or pyo-salpinx exist, they may be overcome by putting the patient under an anæsthetic, dilating the uterus, breaking up what adhesions exist, and thoroughly curetting the endometrium, especially around the openings of the tubes. Intra-uterine galvanism is also useful, and cases have been reported where the obstruction in the tube has been overcome in this way. In the early stages of salpingitis it is well to follow the treatment of Dr. Mangan, of Marseilles—use rest, sedatives, and cold to the abdomen, while hot vaginal injections are employed, and when the case becomes more chronic apply medicated glycerine tampons to the cervix and iodoform pencils to the interior of the uterus. With these remedies it is well to combine tonics and baths.

Should vaginismus be the cause of sterility the remedies employed must be adapted to the cause of the vaginismus. Solutions of lead, silver and

zinc may be employed for the inflammatory process, while cocaine, belladonna and morphia will relieve the irritation and pain. Coitus under chloroform has been advised but does not relieve the trouble. Gradual dilatation with specula has been used, but probably the best remedy is to excise the hymen close to its insertion. When vaginismus is due to uterine fibroids galvanism will usually effect a cure if sufficiently long continued.

In all cases where non-union of the ova and spermatozoa is due to hypertrophy or tumors of either the external or internal organs of generation, the surgeon should remove the cause if possible. The fact of sterile women becoming pregnant after the removal of uterine or ovarian tumors is well known to all.

Should the acid secretions of the vagina be injurious to the spermatozoa, boracic acid will be found to be an excellent remedy. Potter, of Buffalo, employs vaginal tamponnement with this remedy in cases of sterility, and claims good results from its use. Kisch recommends a warm aqueous saccharine solution rendered alkaline by caustic potash, and Chassier uses a solution of white of egg and phosphate of soda, in which the spermatozoa are said to live for a long time.

Where the impediment seems to be due to a thickened cervical secretion, it will be well to introduce a tampon, saturated with glycerine, several hours before coitus, and remove it before the act is accomplished.

Vaginal catarrh can be best remedied by injections of solutions of corrosive sublimate, creolin and boracic acid, though the astringent metallic salts can be used with advantage, and where much pain exists sedatives and demulcents should be employed. Parvin, of Philadelphia, and Jules Chéron, of Paris, speak in the highest terms of

the use of creolin, employed either in solution or as an ointment.

The diagnosis of acute endometritis is usually easy, but where chronic endometritis is suspected it is best to follow the advice of Schultze, of Jena.

This consists in inserting a glycerine tampon against the external os at night, which, on removal in the morning, will have a small quantity of pus on it, if endometritis is present. The cure of simple catarrhal endometritis may be effected by glycerine tampons, and hot douches as recommended by Hermann, of London; or a solution of morphine may be employed with success, according to Siviecceki. Where the cases are more obstinate solutions of nitrate of silver, sulphate of copper, tr. of iodine, carbolic acid or creasote can be used with advantage, but better results are obtained from introducing crayons made from tragacanth dissolved in glycerine and water, which contain iodoform, corrosive sublimate, creolin, resorcin or salol. Where the endometritis has become chronic, Dumontpallier uses Canquoin's paste, and Rheinstaedter, of Cologne, Dorff, of Belgium, and Bröse, of Berlin, speak in the highest terms of a 50 per cent. solution of chloride of zinc applied to the endometrium, which can be followed in a few weeks by a 20 per cent. solution. With the above remedies tonics must be used, and all agents that are calculated to build up the general system. The treatment of salpingitis has been spoken of before, and the line of treatment mapped out.

Where fistulæ exist, surgical procedures must be resorted to, and it is well, where it is possible, to follow Tait's operation, as it probably gives better results than any other.

(c.) Nothing need be said about the artificial means used by women to prevent conception, ex-

cept to condemn them as injurious and unnatural.

(*d.*) It is rare that the physician is called in to treat cases of retarded orgasm or the contrary condition, and when he is, little can be done except to appeal to the moral power while the functions of the body are put in order. In some cases a separation of the man and wife for a lengthy period of time will be found to be very beneficial to both parties, and will overcome the trouble.

3. *Non-implantation*.—Non-implantation after impregnation is due to some trouble in the tubes or the uterus. The treatment of diseased tubes has been spoken of while discussing the union of the ova and the spermatozoa, and it now remains to consider briefly the affections of the uterus.

The prognosis in the undeveloped or atrophied uterus is poor, and yet, with the long continued use of tents, stimulating crayons, hot douches, electricity, massage, emmenagogues, and strict attention to the general health, much good can be obtained. The treatment of peri- and parauterine deposits has been spoken of in connection with uterine displacements, and endometritis was treated of when considering agencies injurious to the life of the spermatozoa. It remains to say, however, that in exceedingly obstinate cases of chronic endometritis, with or without fungous or other growths of the endometrium, the application of the blunt curette will be found most useful. After its application a solution of the subsulphate or the perchloride of iron should be applied to the endometrium, as recommended by Kay, of Scranton, or the iodized phenol can be substituted with advantage, according to Roony, of Quincy.

In curetting the uterus it is well to remember that paralysis of the muscular walls sometimes takes place, and the instrument seems to pass into blank space. Cases of this kind have been re-

ported by Doléris and Geijl. For implantation of the ovum it is necessary to remove all intra-uterine growths, but where they are subserous or situated in the muscular tissue, the application of electricity should be persevered in, as its results are excellent and little danger attends its application. Ergot has been used subcutaneously, but little good has been obtained from its use. If sterility is due to compression of the uterus from intra-abdominal growths, laparotomy must be resorted to to remove the trouble. If cancer of the cervix is taken in time, its removal will justify a favorable prognosis, but where the disease has attacked the body of the organ nothing can be done in the interest of child-bearing.

In cases of membranous dysmenorrhœa the cavity of the uterus can be dilated and various medicinal substances applied to its interior. The curette has also been used with success, and Winckel has had good results from the application of leeches to the cervix uteri. But in many cases all treatment fails to relieve the trouble, and all that can be done is to see to the general health while sedatives and opiates are employed as required. In menorrhagia and metrorrhagia the cause must be looked for and the case treated accordingly.

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